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Employment in Soviet State and Cooperative  
Machine Building and Metalworking, 1940-61

CIA/RR EP 62-80

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#### Foreword

This paper is primarily an attempt to adjust for consistency the published employment data dealing with Soviet industry and the machine building and metalworking branch.

The text discusses briefly some of the relationships revealed by the adjusted series, as well as several important developments in the structure of the labor force.

The adjusted employment estimates will be used in other reports, now in process, which deal with significant current problems in the utilization of manpower in the Soviet machine building and metalworking industry.

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Employment in Soviet State and Cooperative  
Machine Building and Metalworking

The employment of industrial production personnel\* in the machine building and metalworking branch increased at about the same rate between 1950 and 1960 as for the industrial sector as a whole. According to the adjusted series,\*\* employment in the industrial sector increased by 50 percent and that in machine building and metalworking by 51 percent. In the same period, the number of wage workers in the industrial sector increased by 54 percent and in machine building and metalworking, 57 percent.

During the 1950-60 decade, employment in machine building and metalworking maintained a very stable share of total industrial employment. Industrial production personnel in the machine building and metalworking branch averaged about 31.1 percent of the total in all industry, and wage workers in machine building and metalworking about 29.7 percent.

In terms of the total civilian employment, machine building and metalworking accounted for approximately 5 percent in 1950 and 7 percent in 1960.\*\*\*

The machine building and metalworking branch's share of engineering and technical workers is a substantially greater percentage of that of all industry than its share of industrial production personnel. It increased from about 42 percent in 1956 to about 44 percent in 1960. During the same period, the share of engineering and technical workers in machine building and metalworking with specialized secondary and higher education increased from 53 percent to about 70 percent of the total of such workers in the branch.

\* Industrial production personnel includes the following categories of personnel engaged in material production and in services related to production: Wage workers (rabochiye) are persons contributing direct labor to the production process or servicing the production process; engineering-technical personnel; employees (administrative, clerical and professional personnel, other than engineers and technicians); apprentices; junior service personnel (janitors, errand boys, etc.); and guards (plant police, firemen).

\*\* Estimates given in Table 1, p. 2.

\*\*\* Including industrial production personnel not included in Table 1. Total civilian employment has been estimated at nearly 90 million in 1950 and 107 million in 1960.

Table 1  
Estimated Number of Industrial Production Personnel and Wage Workers in State and Cooperative Industry and in Machine Building and Metalworking  
in the USSR, 1940 and 1950-61 <sup>a/</sup>

		Thousands													
Industry		1940	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	
Industrial Production Personnel		12.5	14.9	15.6	16.3	17.2	18.1	18.5	19.2	19.6	20.5	21.4	22.3	23.4	
Wage Workers		9.5	12.1	12.6	13.4	13.9	15.0	15.4	16.0	16.5	17.1	17.8	18.6	19.4	
Other		3.0	2.8	3.0	2.9	3.3	3.1	3.1	3.2	3.1	3.4	3.6	3.7	4.0	
<u>Machine Building and Metalworking</u>															
Industrial Production Personnel		3.8	4.8	4.9	5.1	5.4	5.7	5.8	6.0	6.2	6.4	6.7	7.1	n.a.	
Wage Workers		2.8	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1	5.4	5.7	n.a.	
Other		1.0	1.2	1.1	1.1	1.2	1.3	1.2	1.2	1.3	1.3	1.3	1.4	n.a.	

<sup>a/</sup> Excludes personnel of Volkhov industrial operations and personnel in small industrial operations of other non-industrial organizations.

Engineering and technical workers from 1950 to 1960 comprised between 12 and 13 percent of the industrial-production personnel in the machine building and metalworking branch, compared to about 9 percent in the industrial sector as a whole.

The size and increasing skill level of this key group of workers is a reflection of the importance of machine building and metalworking in the implementation of technological change.

Indicative of technological change within the machine building and metalworking industry are the shifts in worker composition. With the increase in the capital-labor ratio and the introduction of automatic machines, various occupations involving purely manual labor have grown less rapidly than others in which machinery is used -- such as machine setting-up and machine operation. The following tabulation, which shows relative increases in certain worker categories for machine building and metalworking from 1950 to 1959, is indicative of this trend: 1/\*

All Wage Workers**	55 percent
Machine Operators	97 percent
Set-up Men	121 percent

Labor has been less effectively used in auxiliary operations than in basic operations. Consequently, much attention is now being given to mechanization of the auxiliary operations in machine building and metalworking. Soviet estimates of the functional distribution of workers in the industry were made for 1958 on the basis of a 160 plant sample. 2/ The estimated distribution is as follows:

\* For serially numbered source references, see Appendix B, p. 17.  
 \*\* The percentage given for this category is greater than is indicated by the data in Table 2. Although the reasons for the difference are unknown, the 55% figure is retained here for purposes of comparability.

Basic Production Workers	40.3 percent
Auxiliary Workers	59.7 percent
Set-up Men	2.0 percent
Transportation and Storage Workers	15.0 percent
Repair Workers	23.5 percent
Maintenance Workers	10.4 percent
Technical Control Workers	4.7 percent
Other Auxiliary Workers	4.1 percent

The percentage of machine building and metalworking workers in auxiliary work is very high compared to the comparable percentage in total industry. Almost 60% compared with 45-50%. 3/

The number of set-up men in machine building and metalworking, although still relatively small in 1958, is expected to increase vastly as automation is expanded in the industry. One writer indicates that the ratio of set-up men to machine operators varies from one for each 12 to 15 operators in processes using manually operated machine tools to 16 for each operator in some processes using automatic constant-flow lines. 4/

Along with these shifts in worker composition, automation and mechanization will require an increase in the overall skill level of workers. The increased complexity of machinery, greater operating speeds and greater precision requirements make higher skill levels necessary.

Plans for the seven year period, 1959-65, indicate a deceleration of growth for machine building and metalworking compared to the seven year period, 1952-58. Gross production during 1959-65 was planned to increase by 120-124 percent compared with 174 percent in the earlier period. During 1952-58, the number of wage workers in machine building and metalworking increased by 35 percent and gross output per wage worker increased by 102 percent. During the Seven Year Plan period wage worker productivity is to increase by 81 percent. The implicit



increase in the number of wage workers is 22 to 24 percent.

The absolute gain in number of machine building and metalworking wage workers implied by the planned increases in gross production and worker productivity during 1959-65 is slightly smaller than that estimated for the period 1952-58: 1.1 to 1.2 million workers compared with 1.3 million. The gains in gross production per worker, however, are substantial, as the following tabulation shows:

	Gross production per Worker, in Thousands of new Rubles <u>at 1 July 1955 Prices</u>
1951	2.3
Increase during 1952-58	2.3
1958	4.6
Increase during 1959-65	3.8
1965	8.4

The implicit planned saving in manpower due to productivity gains as measured by the number of wage workers in machine building and metalworking also shows an apparent decline during 1959-65 to 5.0 or 5.1 million workers from 5.3 million in 1952-58. The planned average annual rate of growth of wage workers during 1959-65 was 2.9 to 3.1 percent. The actual increase in wage workers between 1958 and 1960 was greater than 5 percent. In the same two-year period, worker productivity appears to have increased at a slightly lower rate (8.7 percent) than the annual average planned rate for 1959-65, which was 8.8 percent. The high rate of increase in wage workers between 1958 and 1960 was, apparently, sufficient to support an overfulfillment in gross production of machine building and metalworking. Gross production increased by about 14.1 percent annually, whereas the planned annual rate of growth for 1959-65 is 11.9 to 12.2 percent.

Appendix A

Methodology for Adjusted Estimates of Employment in State and Cooperative Industry (excluding Kolkhoz Industry) and in State and Cooperative Machine Building and Metalworking

I. Industrial Employment

The employment figures for industry which have been published in the postwar handbooks have not been adjusted to reflect changes in coverage of the data. The methodology developed in this report represents an attempt to estimate employment on a comparable basis for the entire period covered by this report.

Data on workers and employees taken from official publications are presented in Table 2.\* The officially reported data exclude personnel of kolkhoz industrial operations and workers and employees of small industrial subsidiaries of various non-industrial sectors of the economy. For all years prior to 1960, they exclude members of producer cooperatives.

Estimation of industrial production personnel for the years covered by this report with uniform coverage, may be accomplished by use of the official indexes of gross production and of the productivity of labor. If, for a given year, the index of gross production is designated "P" and the index of the productivity of labor (to the same base as for gross production) is designated "L" then the index of the number of personnel, "E" is derived by the formula:  $E = P/L$ .

The indexes of gross industrial production and of the productivity of industrial production personnel are published in the statistical yearbooks of the USSR. Table 3\*\* gives the official data, the derived index of industrial production personnel, and the resulting estimates of the latter.

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\* Table 2 follows on p. 9.

\*\* Table 3 follows on p. 10.

The index of industrial production personnel in column 4 of Table 3 is assumed to cover former industrial cooperatives and state enterprises. The figures in column 5 for the years 1960 and 1961 are reported official data. Derivation of the estimates for 1940 and 1950-59 was by multiplication of the 1960 figure of 22,291 thousand by the appropriate index from column 4.

It is possible to make a crude consistency check of the estimates by comparison with a series constructed by the addition to reported industrial production personnel of reported or estimated data on employment in industrial producer cooperatives. Table 4\* contains the data for the consistency check. From column (6), it is seen that the maximum deviation of the estimates in column (3) from the series in column (5) of Table 3 is 2.7 percent (in 1953) and for most years it is 2.0 percent or less. The index in column (4) is very close to that in column (3) of Table 3, with a maximum deviation of 4 index points (in 1959 and 1960). It is concluded that the estimates presented in Table 3 are reasonable approximations to the industrial production personnel in state and producers cooperative industry.

The technique used in Table 3 to adjust the industrial production personnel series is applied in Table 5\*\* to derive an adjusted series for wage workers in state industry and industrial producers cooperatives.

The adjustment is more difficult to achieve for the machine building and metalworking branch, since there is no officially published labor productivity series covering the entire branch and no base figure is available for industrial production personnel. Indexes of labor productivity covering only machine building are published in the official statistical handbooks. These indexes are probably sufficiently close to labor productivity indexes for the entire machine building and metalworking branch to be used in the derivation of an index of employment in the broader category. Such an index is developed in Table 6\*\*\* for wage workers in machine building

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\* Table 4 follows on p. 11.

\*\* Table 5 follows on p. 12.

\*\*\* Table 6 follows on p. 13.

and metalworking. The 1960 reported figure is used as a base for estimating the wage workers in earlier years. As a consistency check, an alternative method which does not use the productivity of wage workers in machine building is used in Table 7\* to derive estimates of wage workers in machine building and metalworking. This method yields an index (column 5) for 1960 which differs only slightly from that derived in Table 6. The greatest deviation of the index in Table 7 from that in Table 6 was 3 points (for 1940). The greatest relative deviation of the estimates in the consistency check from those in Table 6 was 2.7 percent (in 1958).

Data on total industrial-production personnel for machine building and metalworking are not available for postwar years. An estimate for 1960 may be made on the assumption that the percentage share of wage workers in industrial-production personnel of all Soviet machine building and metalworking was the same as in the RSFSR. The percentage for the RSFSR was given as 79.9. Thus, the total for the USSR is estimated as 7,078 thousand persons. With that figure as a base, estimates for 1940 and 1950 to 1960 are derived in Table 8.\*\*

Indexes of wage workers and of all industrial production personnel in machine building only are developed in Table 9.\*\*\*

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\* Table 7 follows on p. 14.  
 \*\* Table 8 follows on p. 15.  
 \*\*\* Table 9 follows on p. 16.

Table 2

## Reported Industrial Production Personnel for State Industry and for Machine Building and

Metalworking, 1940, 1950 and 1953-61, USSR c/

	1940	1950	1953	1954	1955	1956	1957	1958	1959	1960	1961	Thousands
<u>State Industry</u>												
Total Industrial Production Personnel	10967e/	14144b/	16261d/	17016e/	17367f/	18500g/	19144g/	19675f/	20207f/	22291f/	23350n/	
Workers	8290a/	11308b/	n.a.	13818e/	14281a/	15226h/	15760h/	16279a/	16793a/	18574a/	19420n/	
Apprentices	351a/	320b/	n.a.	n.a.	327a/	337h/	349h/	353a/	341a/	339a/	n.a.	
Engineers & Technicians	932a/	1197b/	n.a.	1530e/	1545a/	1637h/	1689b/	1745a/	1803a/	2008a/	n.a.	
Employees	768a/	710b/	n.a.	818e/	753a/	797h/	810h/	808a/	804a/	897a/	n.a.	
Junior Service Personnel and Guards	626i/	609i/	n.a.	n.a.	461i/	503j/	536j/	490j/	466j/	473j/	n.a.	
<u>Marchin Machine Building &amp; Metalworking Work</u>												
Workers	2395k/	3426l/	n.a.	n.a.	4256k/	4539m/	4736m/	4932k/	5149k/	5655k/	n.a.	
Engineers & Technicians	416p/	n.a.	n.a.	n.a.	n.a.	682p/	n.a.	n.a.	n.a.	n.a.	n.a.	

a. 6/

b. 7/

c. Excludes members of producer cooperatives prior to 1960 and workers and employees of small subsidiary industrial enterprises of various non-industrial ministries and departments. The data for 1955 through 1961 include interplant transport personnel serving material production operations.

d. 8/

e. 9/

f. 10/

g. 11/

h. 12/

i. 13/

j.

k.

l.

j. Obtained as a residual

k. 14/

l. 15/

m. 16/

n. 17/

p. 18/

Table 3

## Derivation of Estimates of State and Cooperative Industrial Production

Personnel in the USSR a/

Year	1 Index of Productivity of Industrial Production Personnel (1950=100) <u>b/</u>	2 Index of Gross Industrial Production (1950=100) <u>c/</u>	3 Index of State and Cooperative Industrial Production Personnel <u>col. (2)</u> <u>col. (1)</u> (1950=100)	4 Col. (3) shifted to 1960 base	5 Estimated number of State and Cooperative Industrial Production Personnel (Thousands)
1940	69	58	84	56	12483
1950	100	100	100	67	14935
1951	110	116	105	70	15604
1952	118	130	110	73	16272
1953	126	145	115	77	17164
1954	136	165	121	81	18056
1955	149	185	124	83	18502
1956	159	205	129	86	19170
1957	171	226	132	88	19616
1958	180	249	138	92	20508
1959	193	277	144	96	21399
1960	203	304	150	100	22291 <u>d/</u>
1961	211	330	156	-	23350 <u>d/</u>

a. Excludes industrial personnel of kolkhozes.

b. Sources: For 1940, 1950, 1953, and 1955-60, 19/ for 1951, 1952, and 1954, 20/; for 1961, 21/.

c. Sources: For 1940 and 1950-59, 22/ for 1960 and 1961, 23/.

d. From Table 2, p. 9, above.

Table 4

## Consistency Check of Estimates in Column (5) of Table 3

	1	2	3	4	5	6
Year	Officially Reported State Industrial Production Personnel (Thousands)	Employment in Industrial Producer Cooperatives (Thousands)	Column (1) plus Column (2)	Index of Column (3) Date (1950=100)	Deviation of Col (3) from Col (5) of Table 3 (Thousands)	Col (5) as percent of Col (5) of Table 3
1940	10967	1557 <u>a/</u>	12524	82	41	0.3
1950	14144	1121 <u>a/</u>	15265	100	330	2.2
1953	16261	1370 <u>a/</u>	17631	115	467	2.7
1954	17016	1415 <u>a/</u>	18431	121	375	2.1
1955	17367	1600 <u>b/</u>	18967	124	465	2.5
1956	18500	1100 <u>c/</u>	19600	128	430	2.2
1957	19144	840 <u>a/</u>	19984	131	368	1.9
1958	19675	1100 <u>d/</u>	20775	136	267	1.3
1959	20207	1200 <u>e/</u>	21407	140	8 less than	.1
1960	22291	0	22291	146	0	0
1961	23350	0	23350	153	0	0

a. Estimate from source 24/b. 25/c. 26/d. 27/e. 28/

Table 5

Derivation of Estimates of State and Cooperative Industrial Wage Workers  
in the USSR a/

Year	1 Index of Productivity of State and Cooperat- ive Industrial Wage Workers (1950=100) <u>b/</u>	2 Index of Gross Indus- trial Pro- duction (1950=100) <u>c/</u>	3 Index of State and Cooperative Industrial Wage Workers <u>Col 2</u> <u>Col 1</u> (1950=100)	4 Col (3) shifted to 1960 base	5 Estimated number of State and Cooperative Industrial Wage Workers (1950=100)
1940	73	58	79	51	9473
1950	100	100	100	65	12073
1951	110	116	105	68	12630
1952	117	130	111	72	13373
1953	125	145	116	75	13930
1954	133	165	124	81	15045
1955	144	185	128	83	15416
1956	155	205	132	86	15974
1957	165	226	137	89	16531
1958	175	249	142	92	17088
1959	187	277	148	96	17831
1960	197	304	154	100	18574 <u>d/</u>
1961	207	330	161	105	19420 <u>d/</u>

a. Excludes industrial personnel of kolkhozes.

b. Sources: For 1940, 1950, 1953 and 1955-60, 29/; for 1951,  
1952 and 1954, 30/; for 1961, 31/.

c. Sources: For 1940 and 1950-59, 32/; for 1960 and 1961, 33/

d. From Table 2, p. 9.



Table 6

Derivation of Estimates of Wage Workers in State and Cooperative Machine  
Building and Metalworking in the USSR a/

	(1)	(2)	(3)	(4)
Year	Index of Productivity of Wage Workers in Machine Building (1950=100)	Index of Gross Production in Machine Building and Metalworking (1950=100)	Index of Wage Workers in Machine Building and Metalworking col. (2) col. (1)	Estimates of Wage Workers in State and Cooperative Machine Building & Metalworking (Thousands) <u>d/</u>
	<u>b/</u>	<u>c/</u>		
1940	59	46	78	2810
1950	100	100	100	3602
1951	114	118	104	3746
1952	126	137	109	3926
1953	137	159	116	4178
1954	152	185	122	4394
1955	175	220	126	4539
1956	192	251	131	4719
1957	210	284	135	4863
1958	230	323	140	5043
1959	253	372	147	5395
1960	271	426	157	<del>5675</del> <u>e/</u>
1961	291	501	172	6195

a. Excludes industrial personnel of Kolkhozes.

b. Sources: For 1940 and 1950-55, 34/ ; for 1956-59, 35/ ; for 1960, 36/ ;  
and for 1961, 37/.

c. Sources: For 1940 and 1950-59, 38/; for 1960 and 1961, 39/.

d. Derived from the index in column (3).

e. From Table 2, p. 9, above.

Table 7

Continuation of Table 6, Reported in Column (4) of Table 6

Year	(1) Adjustment for all Industrial Wage Workers (Thousands)	(2) Ratio of Wage Workers in Machine Building & Metalworking to all Industrial Wage Workers	(3) Adjustment of Machine Building and Metalworking Wage Workers (Thousands)	(4) Adjusted Machine Building and Metalworking Wage Worker Series (Thousands)	(5) Index of Col. (4) (1950=100)	(6) Deviation of Col. (5) from Col. (4) of Table 6 (Thousands)	(7) Col. (6) as Percent of Col. (4) of Table 6
	a/	b/	c/	d/			
1940	1133	.289	342	2737	75	73	2.6
1950	765	.303	232	3559	100	56	1.6
1955	1135	.298	338	4594	126	55	1.2
1956	748	.298	223	4762	130	43	0.9
1957	771	.301	232	4968	136	105	2.1
1958	809	.303	245	5177	142	134	2.7
1959	1038	.307	319	5468	149	73	1.4
1960	0	-	0	5655	155	0	0

a. Col. (5) of Table 5 minus reported industrial wage workers from Table 2.

b. Relationship derived from data in Table 2.

c. Col. (1) times Col. (2).

d. Col. (3) plus reported data on wage workers in machine building from Table 2.

Table 8

Derivation of Estimates of Industrial Production Personnel in State and  
Cooperative Machine Building and Metalworking in the USSR a/

	(1)	(2)	(3)	(4)
	Index of Productivity of Industrial Production Personnel in Machine Building  (b) (1950=100)	Index of Gross Production of Machine Building and Metalworking  (c) (1950=100)	Index of Industrial Production Personnel in Machine Building & Metalworking  (d) (1950=100)	Estimated Number of Industrial Production Personnel in Machine Building & Metalworking (Thousands)
1940	57	46	81	3797
1950	100	100	100	4687
1951	115 <u>e/</u>	118	103	4828
1952	128 <u>e/</u>	137	107	5016
1953	139 <u>e/</u>	159	114	5344
1954	154	185	120	5625
1955	180	220	122	5719
1956	198 <u>f/</u>	251	127	5953
1957	217	284	131	6140
1958	239	323	135	6328
1959	263	372	141	6609
1960	283	426	151	7078 <u>g/</u>
1961	302	501	166	7781

a. Excludes industrial personnel of Kolkhozes.

b. Sources: For 1940, 1954, 1955 and 1957-60, 40/; for 1961, 41/.

c. Sources: Same as for Column 2 of Table 6.

d. Col. (2) \* Col. (1).

e. Based on the assumption that the ratios of the index of the productivity of wage workers in machine building in 1951, 1952 and 1953 to the index in this column were the same as in 1954.

f. Based on the assumption that this index increased over 1955 by the same percentage as the index of the productivity of wage workers in machine building.

g. Based on the assumption that the share of wage workers in total industrial production personnel in machine building and metalworking was the same in 1960 as for the RSFSR-79.9 percent.

Table 9

Derivation of Indexes of Wage Workers and Industrial Production Personnel in  
State and Cooperative Machine Building in the USSR a/

	(1)	(2)	(3)	(4)	(5)
	Index of Productivity of Wage Workers in Machine Building	Index of Gross Production in Machine Building	Derived Index of Wage Workers in Machine Building	Index of Productivity of Industrial Production Personnel in Machine Building	Derived Index of Industrial Production Personnel in Machine Building
	b/ (1950=100)	c/ (1950=100)	d/ (1950=100)	e/ (1950=100)	f/ (1950=100)
1940	59	43	73	57	75
1950	100	100	100	100	100
1951	114	120	105	115	104
1952	126	140	111	128	109
1953	137	169	123	139	122
1954	152	200	132	154	130
1955	175	243	139	180	135
1956	192	283	147	198	143
1957	210	330	157	217	152
1958	230	377	164	239	158
1959	253	435	172	263	165
1960	271	500	185	283	177
1961	291	566	194	302	187

a. Excludes industrial personnel of kolkhozes.

b. Sources: Same as for Column (1) of Table 6.

c. Sources: For 1940 & 1950-60, 42/; for 1961, 43/.

d. Col. (2) ÷ Col. (1).

e. Sources: Same as for column (1) of Table 8.

f. Col. (2) ÷ col. (4).

Appendix E

Source References

1. Voprosy proizvoditel'nosti truda v period stroitel'stva kommunizma, Akademiya Obshchestvennykh Nauk pri Ts KKPSS, Moscow, 1961, p. 362.
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10. JPRS: 12317, 30 Jan 62, p. 636.
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16. JPRS: 6901, 17 March 61, p. 137.
17. SSSR v Tsifrakh v 1961 godu, Moscow, 1962, p. 311.
18. Central Statistical Administration, Dostizheniya Sovetskoy Vlasti za Sorok Let v Tsifrakh, Moscow, 1957, p. 51.
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